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TRADEOFFS IN USING ALTERNATIVE HEIGHT-WEIGHT STANDARDS

Timothy E. Rupinski

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TRADEOFFS IN USING ALTERNATIVE HEIGHT-WEIGHT STANDARDS

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ABSTRACT

This research memorandum examines the feasibility of realigning the weight standards of the Marine Corps to make them more equitable between genders without reducing quality standards. The tradeoffs between equity and recruit quality are summarized to assist policy-makers in selecting the appropriate weight standards.

EXECUTIVE SUMMARY

OBJECTIVE

The Commandant requested that the weight standards of the Marine Corps be realigned to be more equitable between genders without reducing the quality of its manpower. This research memorandum summarizes the effect of realigning height-weight standards on several measures of recruit quality, including education, first-term attrition, and physical fitness.

RESULTS OF STUDY

A much higher proportion of female civilians are ineligible for enlistment in the Marine Corps due to the current accession weight standards than are male civilians from the same age groups. Among 17- to 20-year-olds, 27 percent of female civilians and 3 percent of male civilians exceed the maximum weights under the current accession standards. If equity is defined in terms of civilian eligibility, then the current standards are inequitable. To improve the equity of the standards, male maximum accession weights can be decreased and/or female maximum accession weights can be increased.

Decreasing the maximum accession weights of males could reduce male endstrength or lead to lower educational standards. To offset most of this loss in endstrength and maintain current educational standards, waivers could be granted to male high school graduates who are overweight under the revised accession standards but meet the current accession standards. Alternatively, the Marine Corps could maintain its current weight standards for males, but prioritize potential recruits using the ranking system shown in table I. This system ranks male Marines of a given educational level and weight group based on an analysis of first-term attrition from FY 1982 through FY 1987.

Table I. Relative ranking of male education and weight groups

Active duty weight group	Education group		
	HSG	GED	NGRAD
Not overweight	1	2	3
Overweight: 1-20 lb	2	3	4
Overweight: 21+ lb	3	4	4

The need to meet endstrength requirements in the 1990s will make it difficult to tighten male weight standards, since the size of the eligible male population will continue to shrink. Given the importance of endstrength, the only other way to improve the equity of the weight standards is to increase the maximum accession weights for females. However, higher accession weights for females will reduce the quality of female recruits in terms of physical fitness.

Policy-makers need to assess the tradeoff between physical fitness and eligibility in selecting the appropriate weight standards for females. A 10-pound increase in accession weight for females leads to an estimated reduction in the physical fitness test (PFT) score of 8.4 points. The magnitude of the tradeoff is likely to be understated given the deficiencies with the current PFT. Future research on this issue necessitates that the same PFT be administered to both genders; the test scores be recorded on a semiannual basis as required by current regulations; the first score received on the test be the score that is recorded if the test is retaken; and that height and weight be recorded at the time that the test is given.

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INTRODUCTION

The Commandant requested that the weight standards of the Marine Corps be realigned to be more equitable between genders without reducing the quality of its manpower [1]. This research memorandum summarizes the effect of realigning height-weight standards on several measures of recruit quality, including education, first-term attrition, and physical fitness. Equity is then measured by differences in civilian eligibility for enlistment that can be attributed directly to maximum weight standards. The effects of alternative accession weight standards on eligibility are analyzed for specific age groups. Both the accession standards designed in [2] and the accession standards currently in use by each of the four services are considered.

WEIGHT-EDUCATION TRADEOFF

Marines can be accessed at weights that exceed the maximum weights under the current active duty standards.¹ Table 1 shows how the incidence of overweight among Marine recruits has changed over time. From FY 1982 through FY 1987, the proportion of overweight male recruits has increased 3.3 percentage points, from 9.8 percent to 13.1 percent. In sharp contrast, the proportion of overweight female recruits has increased only 0.1 percentage point over this period. The incidence of overweight among female recruits fell by 2.4 percentage points from FY 1982 to FY 1985, but this reduction was offset by a 2.5-percentage-point increase from FY 1985 to FY 1987.

Table 1. Incidence of overweight under current Marine Corps active duty standards

Year	Proportion overweight	
	Male	Female
1982	9.8	6.6
1983	10.5	5.9
1984	11.4	4.9
1985	12.5	4.2
1986	12.6	4.9
1987	13.1	6.7

1. The weights of Marines cited in this research memorandum are their initial weights at the time of accession.

Reference [2] indicated that the higher incidence of overweight among males relative to females is due to the fact that males can be accessed up to weights 23 to 29 pounds above their active duty maximum weights, whereas females can only be accessed up to weights 0 to 7 pounds above their active duty maximum weights. Since first-term attrition increases with pounds over maximum active duty weight, the increased incidence of overweight among males over time requires further investigation.

Weight relative to the active duty standards and education have both been shown to be important determinants of first-term attrition [2]. For each fiscal year, table 2 shows the proportion of male accessions represented by each education and weight group. Combining the weight groups, the proportion of high school graduates (HSGs) has increased 17.6 percentage points, from 72.5 percent to 90.1 percent, from FY 1982 to FY 1987. Nonoverweight HSGs increased 13.1 percentage points, from 65.1 percent in FY 1982 to 78.2 percent in FY 1987, while overweight HSGs increased 4.5 percentage points, from 7.4 percent to 11.9 percent, over this period. The proportion of HSGs who are overweight increased from 10.2 percent (i.e., $7.4/72.5$) in FY 1982 to 13.2 percent (i.e., $11.9/90.1$) in FY 1987.

The increase in the proportion of HSGs (+17.6) was associated primarily with reductions in the proportion of nonoverweight recruits with less than a high school diploma (-16.5). The proportion of nonoverweight non-high school graduates (NGRADs) and nonoverweight alternative certificate holders (GEDs) declined respectively by 11.8 and 4.7 percentage points. Consequently, the increased incidence of overweight during this period is associated with the substitution of overweight HSGs for nonoverweight recruits with less than a high school diploma.

Manpower training costs can be reduced to the extent that education-weight groups with lower first-term attrition rates are substituted for those with higher first-term attrition rates. Table 3 provides estimates of the difference in male first-term attrition between each education-weight group and nonoverweight HSGs. These estimates are obtained by combining separate results on first-term attrition due to weight and education from tables 18 and 19, respectively, in [2].

Three steps are involved in determining whether the changes in weight and education for new accessions over this five-year period would lower first-term attrition. First, table 4 shows a system for ranking weight-education groups based on the differences in their first-term separation rates relative to those of nonoverweight male recruits at each educational level. The rankings of nonoverweight males in descending order are HSG (1), GED (2), NGRAD (3), and much worse than NGRAD (4). The endpoint of the HSG interval was obtained by averaging the predicted separation rates between nonoverweight HSGs and nonoverweight GEDs. Similarly, the endpoint of the GED interval was obtained by averaging the predicted separation rates between nonoverweight GEDs and

Table 2. Distribution of male recruits' education and weight, by year

Education	Active duty weight group	Proportion in education and weight group						Change 1982-1987
		1982	1983	1984	1985	1986	1987	
HSG	Not overweight	65.1	72.7	76.0	77.0	78.7	78.2	13.1
HSG	Overweight: 1-20 lb	5.8	6.9	7.9	8.7	9.0	9.5	3.7
HSG	Overweight: 21+ lb	1.6	1.6	1.8	2.3	2.4	2.4	.8
GED	Not overweight	11.3	11.1	9.0	7.8	6.7	6.6	-4.7
GED	Overweight: 1-20 lb	.9	1.2	1.0	1.0	.7	.8	-.1
GED	Overweight: 21+ lb	.3	.3	.3	.3	.2	.1	-.2
MGRAD	Not overweight	13.8	5.8	3.7	2.7	2.0	2.0	-11.8
MGRAD	Overweight: 1-20 lb	1.0	.4	.3	.2	.2	.3	-.7
MGRAD	Overweight: 21+ lb	.2	.1	.1	.1	.0	.0	-.2

Table 3. Estimated differences in male first-term attrition relative to non-overweight HSGs (percent)

Active duty weight group	Education group		
	HSG	GED	NGRAD
Not overweight	--	14.2	29.0
Overweight (lb)			
1 to 5	8.1	22.3	37.1
6 to 10	9.7	23.9	38.7
11 to 15	13.1	27.3	42.1
16 to 20	17.9	32.1	46.9
21 to 25	23.9	38.1	52.9
26+	23.3	37.5	52.3

Table 4. System for ranking groups using first-term separation rates

Difference in separation rates (percent)	Comparable active duty nonoverweight group	Relative rank
0 to 7.1	HSG	1
7.2 to 21.6	GED	2
21.7 to 36.4	NGRAD	3
36.5+	Much worse than NGRAD	4

nonoverweight NGRADs. The endpoint of the NGRAD interval was chosen so that the midpoint of the interval would be the predicted separation rate for NGRADs.

In the second step, each weight-education group is categorized using the four-level ranking system. Table 5 indicates that nonoverweight HSGs are the best recruits from the standpoint of first-term attrition. The second-ranked group consists of HSGs that are overweight up to 20 pounds over the maximum active duty weight at median height and non-overweight GEDs. The first- and second-ranked groups satisfy the GED criterion discussed in [2] because their first-term attrition is no worse than that of nonoverweight GEDs. The third-ranked group includes HSGs who are overweight beyond the 20-pound limit, GEDs up to the 20-pound limit, and nonoverweight NGRADs. The bottom-ranked group is composed of GEDs over the 20-pound limit and overweight NGRADs.

Table 5. Relative ranking of education and weight groups based on first-term attrition

Active duty weight group	Education group		
	HSG	GED	NGRAD
Not overweight	1	2	3
Overweight: 1-20 lb	2	3	4
Overweight: 21+ lb	3	4	4

In the third step, the distribution of these ranks is computed for each fiscal year to determine whether the quality of male recruits has improved over time. Table 6 shows how the distribution of ranks has changed from FY 1982 through FY 1987. The top-ranked group increased its proportion of recruits by 13.1 percentage points over this period. The proportions represented by each of the other three groups declined over time. The largest reduction is associated with the third-ranked group. Its proportion decreased 11.1 percentage points over the period. Since the shift in composition of male recruits has been in favor of those with lower first-term attrition rates, the increased incidence of overweight is not a problem.

Table 6. Rank distribution of male recruits

Rank	Proportion of recruits by year						Change 1982-1987
	1982	1983	1984	1985	1986	1987	
1	65.1	72.7	76.0	77.0	78.7	78.2	13.1
2	17.1	18.0	16.9	16.5	15.7	16.1	-1.0
3	16.3	8.6	6.5	6.0	5.1	5.2	-11.1
4	1.5	.8	.7	.6	.4	.4	-1.1

MAXIMUM WEIGHT STANDARDS

This section surveys the maximum weights under the current accession and active duty height-weight standards of the four armed services and compares them to maximum weights consistent with a GED-based criterion.¹ The GED criterion links the accession and active duty weight standards so that first-term attrition is the same at the margin under both the weight and educational accession standards. Under the GED criterion, high school graduates (HSGs) who enter the Marine Corps at the maximum weight under the accession standards will have rates of first-term attrition similar to those of nonoverweight male alternative certificate holders (GEDs). The GED criterion allows the maximum accession weight for males to be 20 pounds over the maximum active duty weight at the median height of 69 inches. For females, the maximum accession weight is set at 10 pounds over the maximum active duty weight at the median height of 64 inches.²

Tables 7 and 8 respectively show alternative maximum weights for males and females at the median height of their genders. Both the Air Force and Navy have recently revised their accession height-weight standards. In both cases, the standards are uniform across different age groups. The Army and the Marine Corps currently adjust their accession standards for age. However, both of these services are reevaluating their height-weight standards.

For males, table 7 indicates that the Air Force has the tightest accession weight standards of the four armed services. In contrast, the Army and Marine Corps, which use the same weight standards for males, are the most lenient in terms of accession weight. The GED-based standards were generated by adding 20 pounds to the maximum weight under the Navy's active duty standards, the Marine Corps' active duty

1. The height-weight standards of the four armed services are contained in appendix A, and the GED-based height-weight standards are contained in appendix B.

2. The methodology used in linking accession and active duty maximum weights is discussed in further detail in [2].

standards, and the overweight standards established by the National Center for Health Statistics (NCHS). The maximum accession weights under the GED-based standards are tighter than the current accession standards of the Marine Corps and looser than the current accession standards of the Air Force.

Table 7. Maximum weight standards for males at median height (69 inches)

Accession weight standard	Maximum weight in pounds		
	Accession	Active duty	Difference
Current accession			
Air Force	189	189	0
Navy	203	182	21
Marine Corps			
17 to 20 years old	209	186	23
21 to 30 years old	215	186	29
Army			
17 to 20 years old	209	175	34
21 to 27 years old	215	179	36
28 to 30 years old	215	184	31
GED-based accession			
Navy active duty + 20 lb	202	182	20
Marine Corps active duty + 20 lb	206	186	20
NCHS overweight + 20 lb	208	188	20

Reference [2] indicated that first-term attrition is positively related to the difference between accession and active duty maximum weights. This difference represents the number of pounds that a recruit would have to lose if he enters the Marine Corps at the maximum weight allowed under the accession standards. In theory, the Army's weight standards for males could lead to the highest rate of weight-related attrition, whereas the Air Force's standards could lead to the lowest rate of weight-related attrition. The GED-based standards would tend to lower male attrition relative to the current standards of the Army, Navy, and Marine Corps because of the smaller gap between accession and active duty maximum weights. It should be noted that the rate of weight-related first-term attrition is not simply a function of the standards but depends to a large extent on the proportion of recruits in the overweight groups.

For females, table 8 shows that the Army has the tightest accession weight standards, whereas the Navy has the most lenient accession weight standards. The standards of the Marine Corps and Air Force fall between those of the Army and the Navy, although they are much closer to those

of the Army. The GED-based accession standards are generated for females by adding 10 pounds to the maximum weights under the Marine Corps' active duty standards, the Navy's active duty standards, an adjusted version of the overweight standards of the National Center for Health Statistics (NCHS), and two active duty standards based on percentiles. Each of the GED-based accession standards falls between the Marine Corps' current accession standards and the Navy's current accession standards.

Table 8. Maximum weight standards for females at median height (64 inches)

Accession weight standard	Maximum weight in pounds		
	Accession	Active duty	Difference
Current accession			
Army			
17 to 20 years old	135	133	2
21 to 24 years old	136	137	-1
25 to 27 years old	139	137	-2
28 to 30 years old	139	145	-6
Marine Corps			
17 to 20 years old	138	138	0
21 to 24 years old	141	138	3
25 to 30 years old	145	138	7
Air Force	146	139	7
Navy	166	145	21
GED-based accession			
Marine Corps active duty + 10 lb	148	138	10
70th percentile + 10 lb	151	141	10
Navy active duty + 10 lb	155	145	10
75th percentile + 10 lb	156	146	10
Adjusted NCHS + 10 lb	162	152	10

The adjusted NCHS overweight standard for females is designed to control for differences in the variance of body mass between genders. To derive the adjusted standard, the maximum body mass for males under the NCHS overweight standard is divided by the median civilian body mass for males. The product of this ratio and the median body mass for females represents the corresponding maximum body mass for females from which the maximum weight at any given height can be computed. This adjustment ensures that the maximum weight at median height is the same multiple of median body mass for both genders.

The adjusted NCHS standard corresponds to the 80th percentile of body mass for females. Note that, while holding height constant, higher

percentiles of body mass are associated with higher weights. For example, a woman in the 80th percentile of body mass weighs more than 80 percent of female civilians in the 20- to 29-year-old age group controlling for height. Female active duty standards are also shown based on the 70th and 75th percentiles of body mass.

Table 9 shows the current Marine Corps active duty maximum weights expressed in terms of percentiles of body mass. At different heights, the maximum weights for males generally correspond to the same body mass. For females, there is substantial variation in body mass across different heights. Shorter females tend to be subject to far more stringent standards than taller females. Specifically, females with heights of 67 inches or less have maximum weights corresponding to the 65th through 70th percentiles of body mass. In contrast, females with heights of 68 inches or more have maximum weights corresponding to the 72nd through 76th percentiles of body mass.

Table 9. Current Marine Corps active duty standards

Height (inches)	Maximum weight in pounds		Percentile of body mass	
	Male	Female	Male	Female
58	--	121	--	70
59	--	123	--	68
60	140	125	83	66
61	145	127	83	65
62	150	130	84	65
63	155	134	84	66
64	160	138	84	66
65	165	142	84	67
66	170	147	84	70
67	175	151	84	70
68	181	156	84	72
69	186	160	84	73
70	192	165	84	74
71	197	170	84	75
72	203	175	84	76
73	209	--	84	--
74	214	--	84	--
75	219	--	83	--
76	225	--	83	--
77	230	--	83	--
78	235	--	82	--

Since body mass varies from the 65th to the 76th percentile for females, one potential solution is to standardize the active duty standards for all heights at the same body mass. Table 10 shows the effect on active duty maximum weights of setting body mass for females at the 70th and 75th percentiles. If the active duty standards are changed to the 70th percentile, then females with heights of less than 67 inches would be subject to higher maximum weights than under current standards. The increase would range from 1 to 5 pounds. However, females who are above 67 inches in height would be subject to tighter standards with reductions in maximum weights of 1 to 7 pounds. Alternatively, if the female active duty standards are adjusted to the 75th percentile, maximum weights would be increased at most heights from the current set of standards. The increase would range from 1 to 9 pounds. Only females at the maximum height of 72 inches would be subject to tighter standards, as their maximum weight would be reduced by 1 pound.

Table 10. Percentile-based female active duty standards

Height (inches)	70th-percentile standard		75th-percentile standard	
	Maximum weight	Change in pounds from current standard	Maximum weight	Change in pounds from current standard
58	122	+ 1	126	+ 5
59	125	+ 2	129	+ 6
60	128	+ 3	132	+ 7
61	131	+ 4	136	+ 9
62	135	+ 5	139	+ 9
63	138	+ 4	143	+ 9
64	141	+ 3	146	+ 8
65	144	+ 2	149	+ 7
66	148	+ 1	153	+ 6
67	151	0	156	+ 5
68	155	- 1	160	+ 4
69	158	- 2	163	+ 3
70	161	- 4	167	+ 2
71	165	- 5	171	+ 1
72	168	- 7	174	- 1

WEIGHT-ELIGIBILITY TRADEOFF

The primary goal of this study is to identify weight standards that are more equitable across genders. One way of measuring equity is to compare the eligibility to enlist in the Marine Corps of male versus female civilians. This section shows how different accession weight

standards affect the eligibility of civilians within a given age bracket and gender. Civilian height-weight data were obtained from the second National Health and Nutrition Examination Survey (NHANES II), which was conducted over the period 1976 through 1980. In addition, the impact of alternative accession standards on the eligibility of previous male accessions will be examined. Height-weight data on Marine Corps accessions was obtained from the Accession Resource Management System (ARMS) over the period 1982 through 1987. Since Marines are typically accessed between the ages of 17 and 30 years, the analysis will focus on eligibility within this range of ages.

In tables 1 through 6, overweight was defined relative to the current active duty standards of the Marine Corps. In this section, overweight will be defined relative to the alternative accession standards presented in tables 7 and 8. Table 11 shows the incidence of overweight in the male and female civilian populations under the current accession standards of each of the four services. Based on the maximum weights under the current Marine Corps accession standards, 3 to 5 percent of male civilians would be ineligible for enlistment. In contrast, 25 to 30 percent of female civilians would be ineligible for enlistment in the Marine Corps because their weight exceeds the maximum weight under the current standards. The differences in eligibility between genders range from 22 to 25 percentage points.

The Army's accession weight standards are the least equitable of the four services. The difference in civilian eligibility between genders ranges from 26 to 31 percentage points. In contrast, the Navy has the most equitable accession weight standards of the four services. Differences in eligibility between genders range from 3 to 7 percentage points. The Air Force's accession weight standards are less equitable than those of the Navy and more equitable than those of the Army and the Marine Corps. Eligibility differences between men and women range from 9 to 11 percentage points.

The greater equity of the Air Force weight standards relative to those of the Marine Corps is partially offset by the Air Force's less equitable height standards. Females in the Marine Corps are required to measure from 58 to 72 inches in height. In contrast, the Air Force excludes women who are less than 60 inches tall but includes women who are more than 72 inches tall. In the civilian sample, 5.9 percent of females have heights of 58 and 59 inches while only 0.3 percent of females have heights exceeding 71 inches. Army and Navy height standards are comparable in terms of equity to those of the Marine Corps because they have the same minimum height requirement for females of 58 inches.

Table 11. Incidence of overweight in civilian population under current service accession standards

	<u>Proportion overweight</u>		Percentage- point difference
	Female	Male	
Marine Corps			
17 to 20 years old	27	3	24
21 to 24 years old	25	3	22
25 to 30 years old	30	5	25
Army			
17 to 20 years old	31	3	28
21 to 24 years old	29	3	26
25 to 30 years old	36	5	31
Navy			
17 to 20 years old	7	4	3
21 to 24 years old	10	7	3
25 to 30 years old	16	9	7
Air Force			
17 to 20 years old	16	7	9
21 to 24 years old	20	12	8
25 to 30 years old	28	17	11

Based on the criterion of civilian eligibility, females are subject to stricter weight standards than males in each of the four services. To reduce that difference in eligibility in the Marine Corps, male accession weight standards can be tightened, or female accession weight standards can be loosened, or both. Table 12 shows the incidence of overweight in the male and female civilian populations under the GED-based accession standards. Relative to the current Marine Corps accession weight standards, the male GED-based standards are tighter and the female GED-based standards are looser. Consequently, any combination of the male and female accession standards in this table would lead to more equitable accession standards as defined by differences in civilian eligibility.

Although the primary goal of the study is to improve the equity of weight standards between men and women, this goal is qualified by the proviso that quality standards not be reduced. However, the tightening of accession weight standards for all male recruits could lead to the accession of lower-quality male recruits in terms of education in order to meet endstrength requirements.

Table 12. Incidence of overweight in civilian population under GED-based accession standards

Accession weight standard	Proportion overweight in age group		
	17-20	21-24	25-30
Male			
Navy active duty + 20 lb	4	7	10
Marine Corps active duty + 20 lb	4	6	8
NCHS overweight + 20 lbs	3	5	7
Female			
Marine Corps active duty + 10 lb	16	19	27
70th percentile + 10 lb	13	18	24
Navy active duty + 10 lb	11	16	21
75th percentile + 10 lb	10	15	21
Adjusted NCHS + 10 lb	8	12	17

Table 13 shows the incidence of overweight among male recruits in the Marine Corps under the current accession standards used by each of the four services as well as the accession standards implied by the GED criterion. Only .5 percent of the male Marines exceed the maximum weights under the current Marine Corps accession standards. If male Marine recruits had been subjected to the stricter accession standards of the Navy, 3.6 percent would have been ineligible. Under the more stringent standards of the Air Force, 10.0 percent of the male Marine recruits would have been ineligible. Alternatively, the GED-based accession standards would imply ineligibility rates ranging from 1.3 percent to 4.0 percent.

To prevent the lowering of educational requirements to meet end-strength, most of the reductions in eligibility could be offset by waivers to male high school graduates who exceed the weight standards. If the Marine Corps continues to use the same active duty standards for males and applies the GED criteria, 2.3 percent of previous male accessions would have been ineligible. However, a waiver to overweight male high school graduates would lead to the accession of 85.2 percent of those previously considered ineligible under the weight standards. In effect, only 0.3 percent (i.e., $(1-.852) \times .023$) of previous male accessions would have been ineligible.

Table 13. Incidence of overweight among male Marine recruits under alternative accession standards

Accession weight standard	Proportion overweight in age group			
	17-20	21-24	25-30	All
Current accession				
Marine Corps	.5	.5	.5	.5
Army	.5	.5	.5	.5
Navy	3.1	6.4	6.8	3.6
Air Force	9.1	14.8	15.5	10.0
GED-based accession				
Navy active duty + 20 lb	3.5	6.9	7.2	4.0
Marine Corps active duty + 20 lb	1.8	4.8	5.3	2.3
NCHS overweight + 20 lb	0.9	3.8	4.1	1.3

WEIGHT-PHYSICAL FITNESS TRADEOFF

Male end-strength requirements tend to rule out the tightening of male accession weight standards unless sufficient waivers are permitted for overweight high school graduates. The only other way of improving equity is to loosen female accession standards. However, this would have the effect of reducing the physical fitness of female recruits. Reference [3] found that the physical fitness of Marine recruits decreases with respect to weight. For males, a 10-pound increase in accession weight was found to decrease the physical fitness test (PFT) score by 3.5 points. For females, a 10-pound increase in accession weight was associated with an 8.4 point decrease in the PFT score.¹

The estimated relationship between physical fitness and weight may be understated due to data limitations. Ideally, physical fitness and weight should be measured at the same time. However, height and weight data are only available from the time of accession, and the first PFT score is typically recorded at about six months into the first term. The time lag between these measures may have weakened the estimated relationship between the measures. In addition, unsatisfactory PFT scores were never observed in the data base. The estimated tradeoff between physical fitness and weight would be further understated to the extent that Marines who would have received unsatisfactory scores did not have those scores recorded, retook the PFT until they received a satisfactory score, or separated before taking the test.

1. The mean accession weights are 159 pounds for males and 127 pounds for females. Each gender is given a different PFT. On a scale of 300 points, the mean PFT scores are 245 for males and 222 for females.

CONCLUSIONS

A much higher proportion of female civilians are ineligible for enlistment in the Marine Corps due to the current accession standards than are male civilians from the same age groups. If equity is defined in terms of civilian eligibility, then the current standards are inequitable. To improve the equity of the standards, male maximum accession weights can be decreased and/or female maximum accession weights can be increased. A variety of GED-based standards that meet this criterion have been presented.

Under current educational standards, decreasing the maximum accession weights of males will tend to reduce male endstrength. To offset most of this loss in endstrength, waivers could be granted to male high school graduates who are overweight under the revised accession standards but meet the current accession standards. Alternatively, the Marine Corps could maintain its current standards, but prioritize potential recruits using the ranking system shown in table 5. In either case, the need to meet endstrength requirements in the 1990s will make it difficult to tighten weight standards, while the size of the eligible male population continues to shrink.

Increasing the maximum accession weights for females will reduce their physical fitness. Policy-makers need to assess the tradeoff between physical fitness and eligibility in selecting the appropriate weight standards for females. The magnitude of the tradeoff is likely to be understated given the estimation problems associated with the current PFT. Future research on this issue necessitates that the same PFT be given to both genders; the test scores be recorded on a semiannual basis, as required by current regulations; the first score on the test be the score that is recorded if the test is retaken; and that height and weight also be recorded at the time the test is given.

REFERENCES

- [1] Commandant of the Marine Corps, ltr Ser RDD 400505, *Request for MCOAG Analytical Support, Marine Corps Weight and Fitness Standards*, 12 May 1988
- [2] CNA Research Memorandum 89-16, *Using Attrition Rates in Setting Height-Weight Standards*, by Timothy E. Rupinski, May 1989 (27890016)
- [3] CNA Research Memorandum 88-190, *Physical Fitness of Marine Corps Recruits*, by Timothy E. Rupinski, Apr 1989 (27880190)

1. The number in parentheses is a CNA internal control number.

APPENDIX A
ARMED FORCES MAXIMUM WEIGHT STANDARDS

Table A-1. Marine Corps maximum weight standards (male)

Height (inches)	Maximum accession weight, by age group					Maximum active duty weight
	16-20	21-30	31-35	36-40	Over 40	
60	158	163	162	157	150	140
61	163	168	167	162	155	145
62	168	174	173	168	160	150
63	174	180	178	173	165	155
64	179	185	184	179	171	160
65	185	191	190	184	176	165
66	191	197	196	190	182	170
67	197	203	202	196	187	175
68	203	209	208	202	193	181
69	209	215	214	208	198	186
70	215	222	220	214	204	192
71	221	228	227	220	210	197
72	227	234	233	226	216	203
73	233	241	240	233	222	209
74	240	248	246	239	228	214
75	246	254	253	246	234	219
76	253	261	260	252	241	225
77	260	268	266	259	247	230
78	267	275	273	266	254	235

Table A-2. Marine Corps maximum weight standards (female)

Height (inches)	Maximum accession weight, by age group						Maximum active duty weight
	16-20	21-24	25-30	31-35	36-40	Over 40	
58	121	123	124	126	135	135	121
59	123	125	129	129	139	138	123
60	125	127	132	132	142	141	125
61	127	129	135	136	145	147	127
62	130	132	139	141	148	147	130
63	134	137	141	145	151	150	134
64	138	141	145	150	156	154	138
65	142	145	149	155	161	159	142
66	147	150	154	160	165	164	147
67	151	155	159	165	171	169	151
68	156	159	163	169	176	174	156
69	160	164	168	175	181	179	160
70	165	169	173	180	186	184	165
71	170	174	178	185	192	190	170
72	175	178	183	190	197	195	175

Table A-3. Army maximum weight standards (male)

Height (inches)	Maximum accession weight	Maximum active duty weight, by age group			
		17-20	21-27	28-39	Over 39
60	Same as Marine Corps accession standard	132	136	139	141
61		136	140	144	146
62		141	144	148	150
63		145	149	153	155
64		150	154	158	160
65		155	159	163	165
66		160	163	168	170
67		165	169	174	176
68		170	174	179	181
69		175	179	184	186
70		180	185	189	192
71		185	189	194	197
72		190	195	200	203
73		195	200	205	208
74		201	206	211	214
75		206	212	217	220
76		212	217	223	226
77		218	223	229	232
78		223	229	235	238
79		229	235	241	244
80		234	240	247	250

Table A-4. Army maximum accession weight standards
(female)

Height (inches)	Maximum accession weight, by age group					
	16-20	21-24	25-30	31-35	36-40	Over 40
58	120	124	126	129	132	135
59	122	126	128	131	134	137
60	124	128	130	133	136	139
61	127	130	132	135	139	141
62	128	132	134	137	140	144
63	132	134	136	139	143	145
64	135	136	139	143	145	149
65	138	140	144	148	150	153
66	141	145	148	151	154	157
67	145	149	152	156	158	162
68	150	153	156	160	162	166
69	154	157	161	164	167	170
70	158	162	165	168	171	174
71	162	166	169	173	175	179
72	167	171	174	178	181	184
73	171	177	179	183	186	190
74	175	182	185	188	191	195
75	179	187	190	194	196	200
76	184	192	196	199	202	205
77	188	197	201	204	207	211
78	192	203	206	209	213	216
79	196	208	211	215	218	220
80	201	213	216	219	223	225

Table A-5. Army maximum active duty weight standards (female)

Height (inches)	Maximum active duty weight, by age group			
	17-20	21-27	28-39	Over 39
58	109	112	115	119
59	113	116	119	123
60	116	120	123	127
61	120	124	127	131
62	125	129	132	137
63	129	133	137	141
64	133	137	141	145
65	137	141	145	149
66	141	146	150	154
67	145	149	154	159
68	150	154	159	164
69	154	158	163	168
70	159	163	168	173
71	163	167	172	177
72	167	172	177	183
73	172	177	182	188
74	178	183	189	194
75	183	188	194	200
76	189	194	200	206
77	193	199	205	211
78	198	204	210	216
79	203	209	215	222
80	208	214	220	227

Table A-6. Navy maximum weight standards (male)

Height (inches)	Maximum accession weight	Maximum active duty weight
60	155	139
61	160	143
62	165	148
63	170	152
64	176	157
65	181	162
66	186	167
67	192	172
68	197	176
69	203	182
70	209	187
71	215	192
72	220	197
73	226	202
74	232	208
75	239	213
76	245	219
77	251	224
78	257	230

Table A-7. Navy maximum weight standards (female)

Height (inches)	Maximum accession weight	Maximum active duty weight
58	144	124
59	148	127
60	151	131
61	155	135
62	159	138
63	162	142
64	166	145
65	169	149
66	173	153
67	177	156
68	180	160
69	184	163
70	187	167
71	191	171
72	195	175
73	198	178
74	202	181
75	205	185
76	209	189
77	213	192
78	216	196

Table A-8. Air Force maximum weight standards (male)

Height (inches)	Maximum weight under both accession and active duty standards
60	153
61	155
62	158
63	160
64	164
65	169
66	174
67	179
68	184
69	189
70	194
71	199
72	205
73	211
74	218
75	224
76	230
77	236
78	242
79	248
80	254

Table A-9. Air Force maximum weight standards (female)

Height (inches)	Maximum accession weight	Maximum active duty weight
60	136	130
61	138	132
62	141	134
63	142	136
64	146	139
65	150	144
66	155	148
67	159	152
68	164	156
69	168	161
70	173	165
71	177	169
72	182	174
73	188	179
74	194	185
75	199	190
76	205	196
77	210	201
78	215	206
79	221	212
80	226	218

APPENDIX B
GED-BASED MAXIMUM WEIGHT STANDARDS

Table B-1. GED-based accession standards assuming Navy active duty standards (male)

Height (inches)	<u>Maximum weight in pounds</u>	
	Navy active duty	GED-based accession
60	139	153
61	143	158
62	148	163
63	152	168
64	157	174
65	162	179
66	167	185
67	172	190
68	176	196
69	182	202
70	187	208
71	192	214
72	197	220
73	202	226
74	208	232
75	213	239
76	219	245
77	224	252
78	230	258

Table B-2. GED-based accession standards assuming Marine Corps active duty standards (male)

Height (inches)	<u>Maximum weight in pounds</u>	
	Marine Corps active duty	GED-based accession
60	140	156
61	145	161
62	150	166
63	155	172
64	160	177
65	165	183
66	170	188
67	175	194
68	181	200
69	186	206
70	192	212
71	197	218
72	203	224
73	209	231
74	214	237
75	219	243
76	225	250
77	230	257
78	235	263

Table B-3. GED-based accession standards assuming NCHS overweight active duty standards (male)

Height (inches)	<u>Maximum weight in pounds</u>	
	NCHS active duty	GED-based accession
60	142	157
61	147	163
62	152	168
63	157	173
64	162	179
65	167	185
66	172	190
67	177	196
68	183	202
69	188	208
70	194	214
71	199	220
72	205	226
73	211	233
74	216	239
75	222	246
76	228	252
77	234	259
78	240	266

Table B-4. GED-based accession standards assuming Marine Corps active duty standards (female)

Height (inches)	<u>Maximum weight in pounds</u>	
	Marine Corps active duty	GED-based accession
58	121	128
59	123	131
60	125	134
61	127	138
62	130	141
63	134	145
64	138	148
65	142	151
66	147	155
67	151	159
68	156	162
69	160	166
70	165	169
71	170	173
72	175	177

Table B-5. GED-based accession standards assuming 70th-percentile active duty standards (female)

Height (inches)	<u>Maximum weight in pounds</u>	
	70th- percentile active duty	GED-based accession
58	122	130
59	125	134
60	128	137
61	131	141
62	135	144
63	138	147
64	141	151
65	144	155
66	148	158
67	151	162
68	155	165
69	158	169
70	161	173
71	165	176
72	168	180

Table B-6. GED-based accession standards assuming Navy active duty standards (female)

Height (inches)	<u>Maximum weight in pounds</u>	
	Navy active duty	GED-based accession
58	124	134
59	127	137
60	131	141
61	135	144
62	138	148
63	142	151
64	145	155
65	149	159
66	153	162
67	156	166
68	160	170
69	163	174
70	167	177
71	171	181
72	175	185

Table B-7. GED-based accession standards assuming 75th-percentile active duty standards (male)

<u>Maximum weight in pounds</u>		
<u>Height (inches)</u>	<u>75th- percentile active duty</u>	<u>GED-based accession</u>
58	126	135
59	129	138
60	132	142
61	136	145
62	139	149
63	143	152
64	146	156
65	149	160
66	153	163
67	156	167
68	160	171
69	163	175
70	167	178
71	171	182
72	174	186

Table B-8. GED-based accession standards assuming adjusted NCHS overweight active duty standards (female)

Height (inches)	<u>Maximum weight in pounds</u>	
	Adjusted NCHS active duty	GED-based accession
58	131	140
59	134	143
60	138	147
61	141	151
62	145	154
63	148	158
64	152	162
65	155	166
66	159	170
67	162	174
68	166	177
69	170	181
70	173	185
71	177	189
72	181	193